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Ingram, III

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(54) **COMPACT CREEL**

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(60) Provisional application No. 60/134,589, filed on May 17, 1999, provisional application No. 60/107,495, filed on Nov. 6, 1998, provisional application No. 60/107,494, filed on Nov. 6, 1998.

(51) **Int. Cl.**
B65H 49/02 (2006.01)
B65H 57/00 (2006.01)

(52) **U.S. Cl.** ..... **242/131.1**; 242/157 R; 242/594.6

(58) **Field of Classification Search** ..... 242/131, 242/131.1, 157 R, 129.62, 129.72, 594.4–594
See application file for complete search history.

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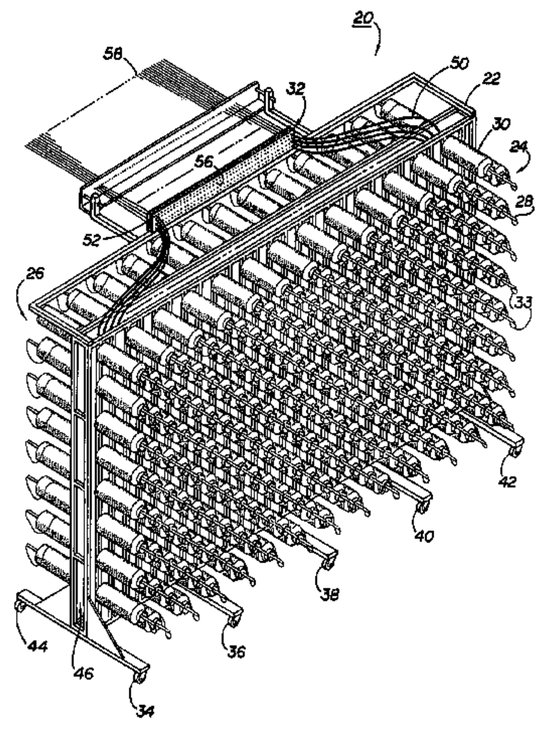
(57) **ABSTRACT**

A highly mobile, compact creel that utilizes frames for holding yarn packages (or bobbins) for feeding yarn to a tufting machine. Each frame includes holders affixed to the frame for holding yarn packages facing front and back, a header attachable to the frame for directing yarn from the yarn packages to the tufting machine, and anti-static flexible tubing for leading yarn from the holders to the header. The header provides for aligning all the yarn ends in the same plane to join them to ends already threaded into the tufting machine. An optional frame overlay upright having a ring affixed thereto and strands threaded through the ring prevents yarn from upper yarn packages from falling onto tubes holding lower yarn packages causing yarn entanglement.

12 Claims, 6 Drawing Sheets



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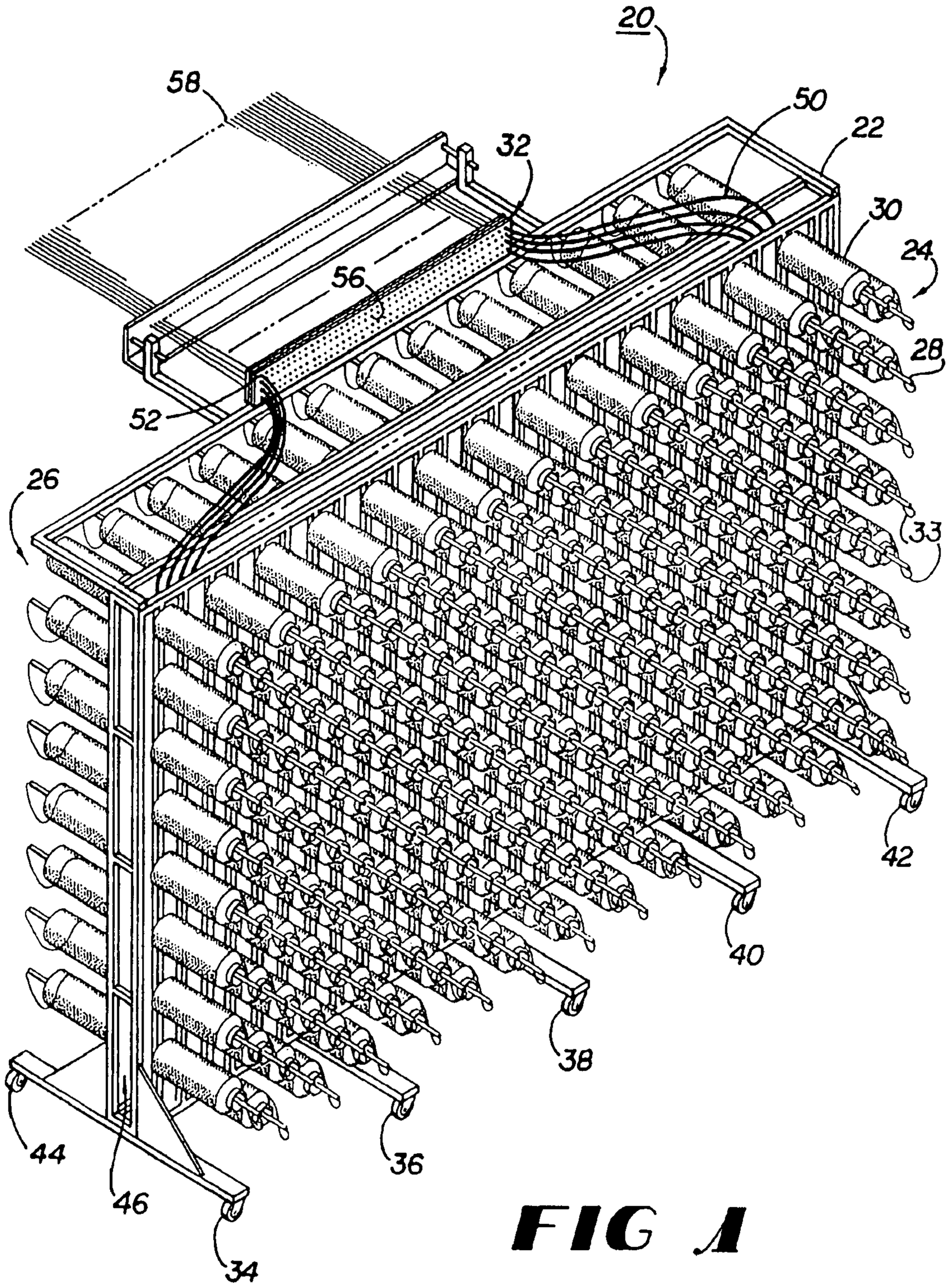

FIG 1

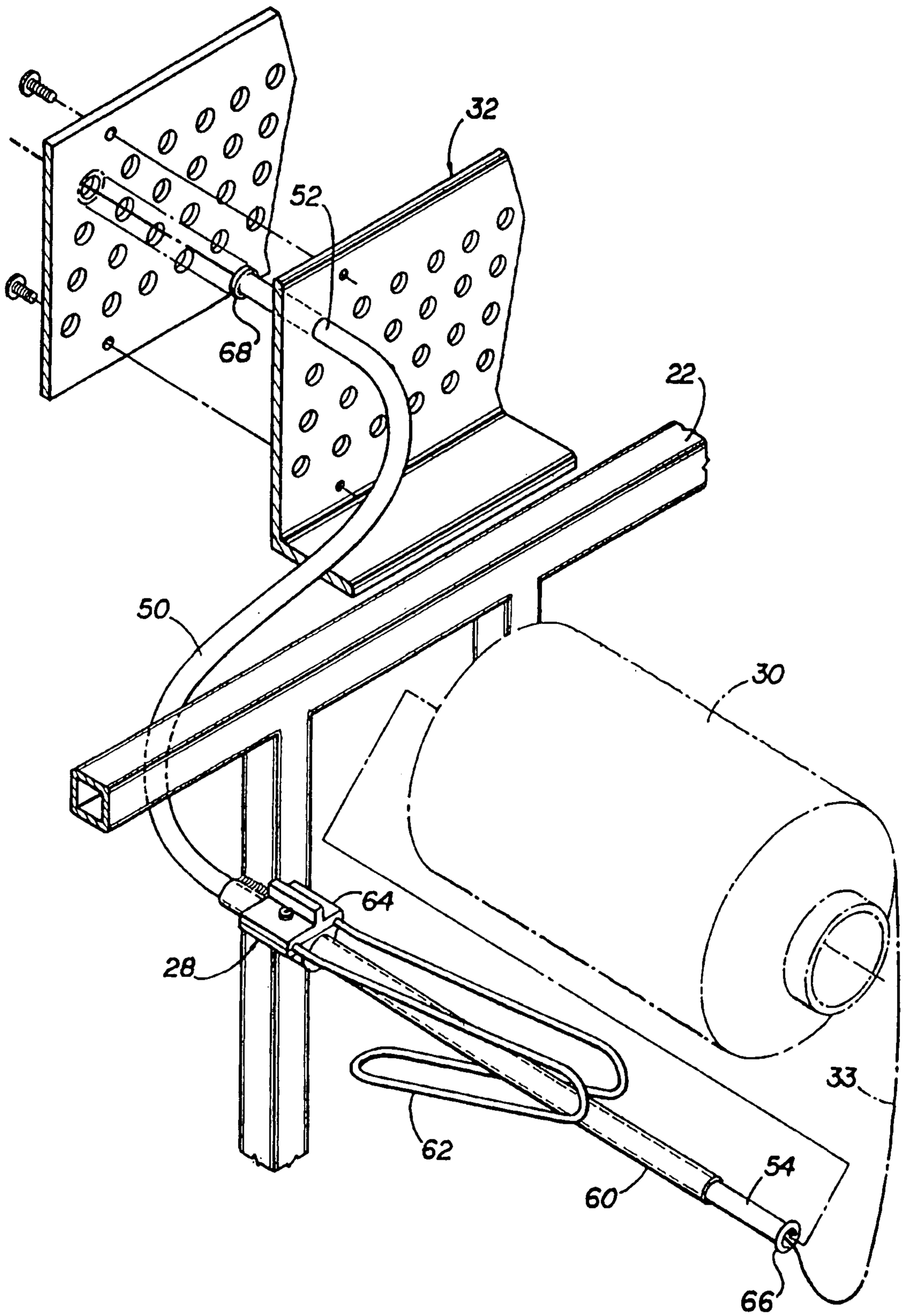

FIG 2

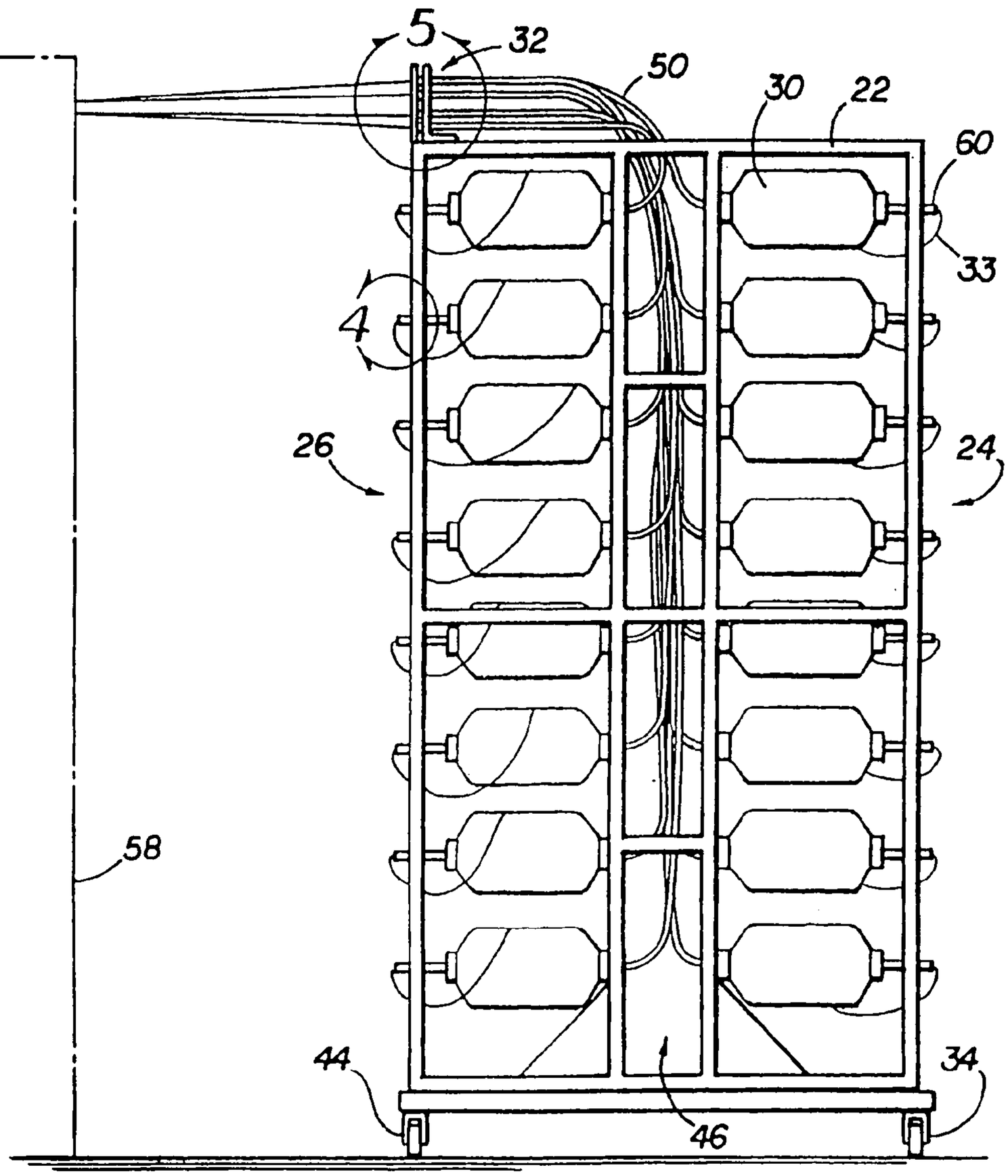

FIG 3

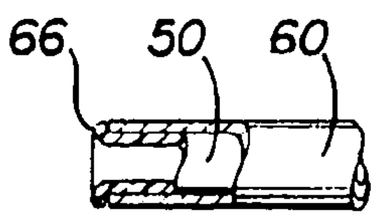

FIG 4

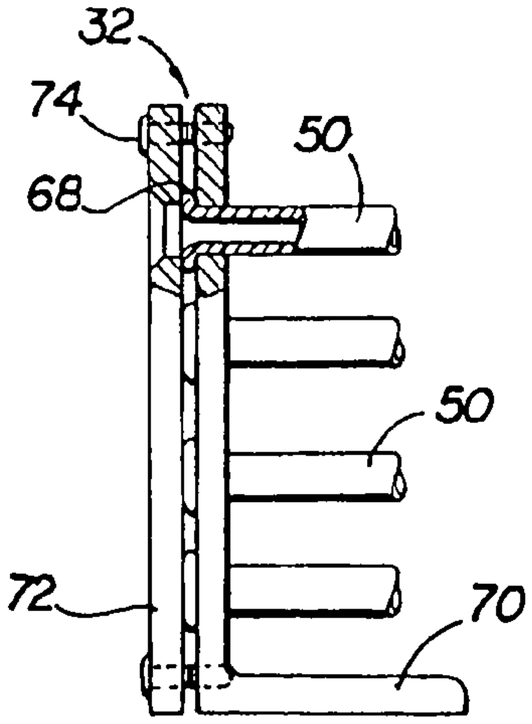

FIG 5

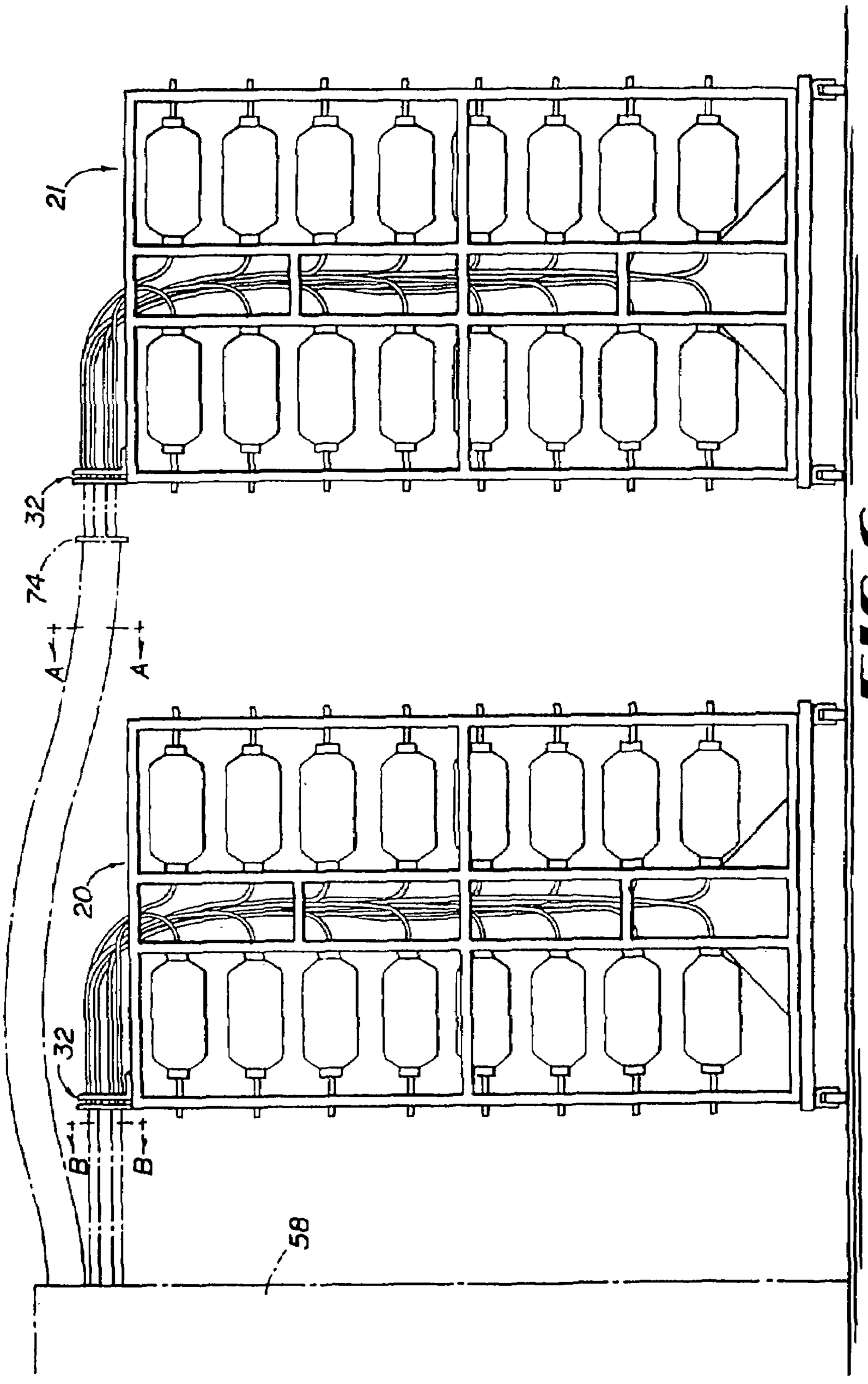

FIG 6

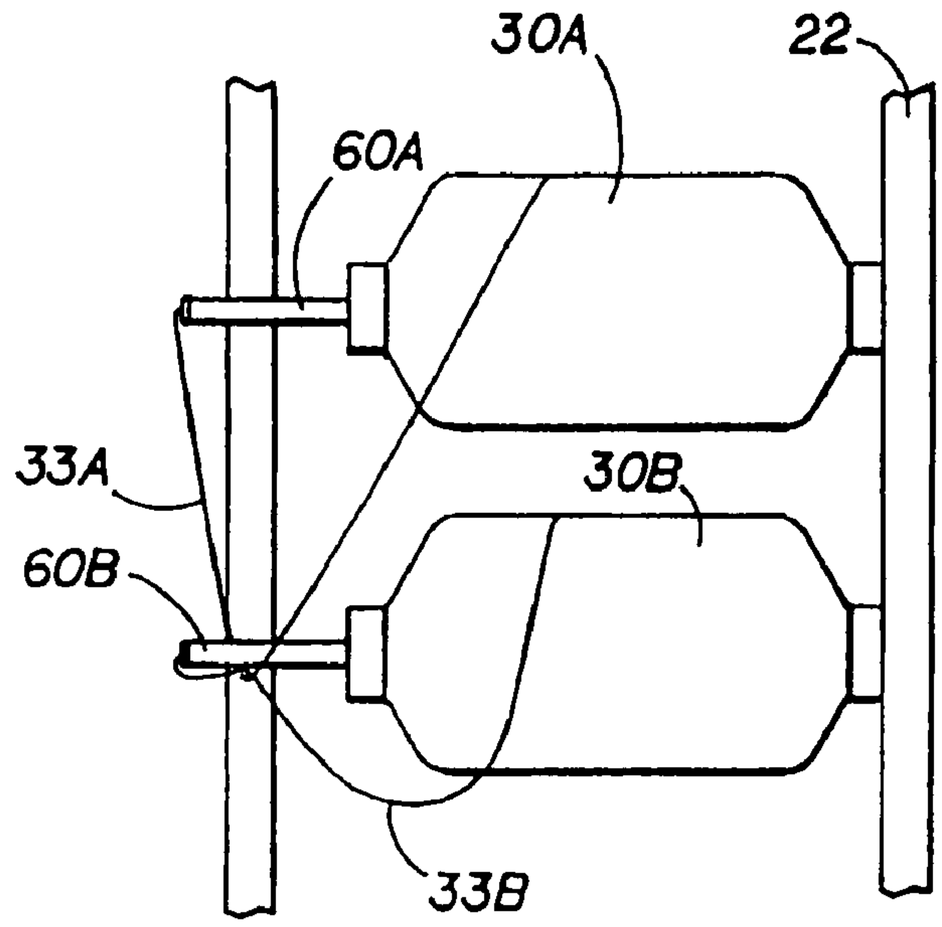

FIG 7

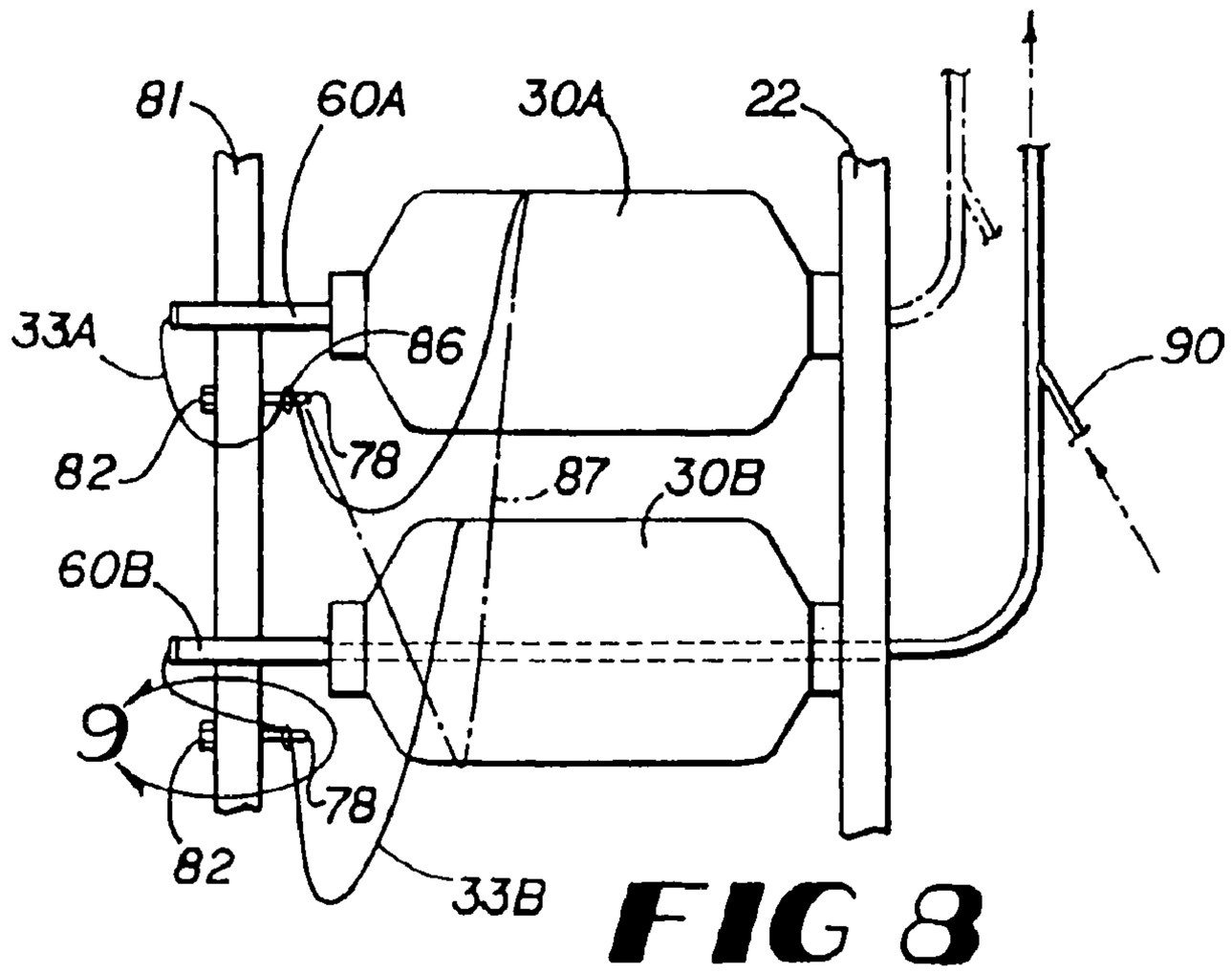

FIG 8

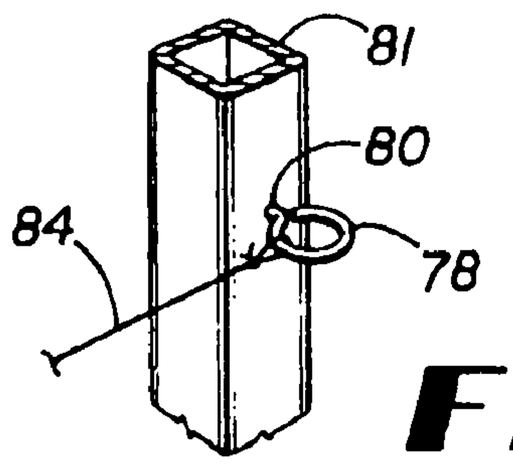

FIG 9

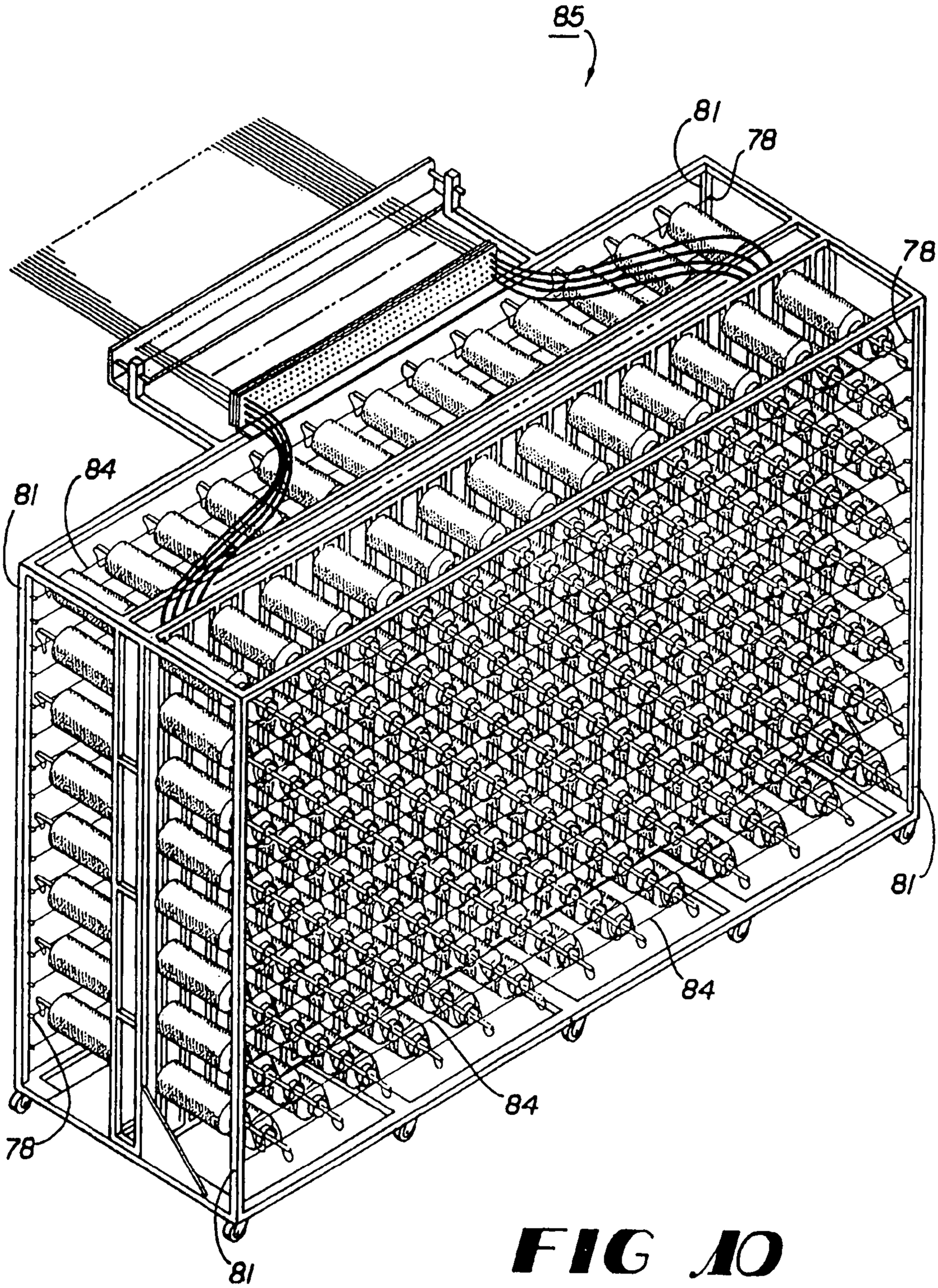

FIG 10

COMPACT CREEL

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 10/642,003 filed Aug. 15, 2003, now U.S. Pat. No. 7,004,415, which is a continuation of U.S. patent application Ser. No. 09/830,733 filed Jul. 23, 2001, now U.S. Pat. No. 6,634,585, which is a 35 USC 371 National Phase Application of PCT/US99/25985 filed Nov. 4, 1999, published as WO 00/27532, which claims priority to U.S. Provisional Application No. 60/107,494 filed Nov. 6, 1998, entitled, "Compressed Portable Tufting Creel," and U.S. Provisional Application No. 60/107,495 filed Nov. 6, 1998, entitled, "Alignment Header for Burning-In Process," and U.S. Provisional Application No. 60/134,589 filed May 17, 1999, entitled, "Compact Creel," all which are incorporated by reference herein.

BACKGROUND OF THE INVENTION

Carpet tufting machines are relatively compact devices. However, substantial space within a carpet production facility is required for the entire tufting process. In addition to the space occupied by a tufting machine (i.e. the tufter) itself, there must be roll-up or additional processing equipment, or both, positioned downstream from the tufter.

Substantial additional space is required to supply yarn to the tufter. Yarn is typically supplied directly to the tufter by one of two methods. It may come from a "creel," which is a rack holding large bobbins or packages of yarn that spool off of the bobbins and into the tufter. Conventional creels occupy substantial floor space "upstream" from the tufter because of the size of the packages or bobbins of yarn and the space needed to hold them so that the many separate strands of yarn can be pulled off the bobbins and fed into the tufting machine. The floor space required by a standard warper and creel is on the order of 2,000 square feet.

Alternatively, yarn can be fed to the tufting machine from a "beam," a large horizontal mandrel onto which multiple strands of yarn of the needed colors are wound in advance. The yarn strands are then unwound simultaneously from the beam into the tufter. While beams typically require substantially less space immediately in front of the tufter than conventional creels, substantial space is needed, and significant work is required to prepare the beam, because in order to position yarn on a beam, bobbins or yarn packages must be positioned on creels to "feed" the beam, much as the yarn packages would be positioned to feed a tufter directly.

A significant challenge to carpet manufacturers is to reduce the amount of yarn waste occurring in the manufacturing of carpet. Wasted yarn can occur in several stages during the manufacturing process. For example, there can be yarn waste due to tufting beam waste, production beam waste and/or warping beam waste. A cause of waste is the inability to effectively determine the amount of yarn that is needed for a particular piece of carpet. As yarn is fed into a tufting machine it may be realized that yarn length for one color in a pattern is too short while yarn length for another color in the pattern is too long, resulting in wasted yarn. Large bobbins of yarn or beams of yarn compound the problem due to the sheer size of the yarn contained. A compact creel with smaller yarn packages reduces waste in the manufacturing process. Another significant problem is carpet overrun overage.

Therefore, a need exists for a compact creel that occupies less space on the manufacturing floor and reduces yarn waste in the manufacturing process, while enabling the same quantities of carpet production as that produced from a conventional creel.

SUMMARY OF THE INVENTION

This invention is a highly mobile, compact creel that utilizes frames for holding yarn packages (or bobbins), where the packages may be in the form supplied by the yarn supplier (typical sizes are initially about 6 inches or about 10-11 inches in diameter). Each frame can hold yarn packages facing front and back. Each creel frame can hold, for instance, about 416 yarn packages, for a total of approximately 832 yarn packages, so that the two sides of the frames together hold sufficient yarn ends for a typical carpet tufting machine. Other numbers of packages can also be accommodated, and multiple frames can be used to feed a single tufting machine.

A header having adjustable bars and slots for the yarn mates and affixes to the frame. This header provides for aligning all of the yarn ends in the same plane in order to join them to ends already threaded into the tufting machine.

In operation, yarn spools off of the end of the yarn package, through an eyelet (or yarn eye), through a rigid tube affixed to the frame (and inside the hollow yarn package), and through a flexible tube leading to the top of the frame, and into the header. The flexible tube typically passes through the rigid tube on which the package rests and a yarn eye at the end of the rigid tube can be formed on the end of the flexible tube. The floor space required for two 16 foot frames of the compact creel of this invention is on the order of 160 square feet.

A yarn reclamation procedure of this invention strips the yarn packages without unloading the yarn packages from the creel. The ends of the yarn tie from head to tail. The portable creel is placed in front of a backwinder head, and skinner yarn pieces wind onto one package or a few packages.

Objects of this invention include:

To provide a compact creel that reduces yarn waste in the tufting, production and warping processes.

To provide an alternative use for warping beam yarn, other than overrun carpet or beam waste.

To provide a compact creel that increases the quality of the finished product by reducing slack ends.

To provide yarn inventory reduction and decreased amounts of material handling.

To provide a compact creel that requires less floor space.

To provide an efficient reclamation procedure.

To provide a compact creel that reduces the labor required in the warping process.

To provide simplified scheduling and increased plant through-put time.

To provide all the same features for sample production and carpet development.

As the following description and accompanying drawings make clear, these and other objects are achieved by this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of both sides of a compact creel of this invention including a frame, a header, yarn packages on hollow supports and flexible tubing.

FIG. **2** is an exploded perspective view of a portion of the compact creel of FIG. **1**, including a hollow support for a yarn package shown in broken lines and a support, a flexible yarn tube and a portion of the header.

FIG. **3** is a side elevation view of a front and rear portion of the creel of FIG. **1**.

FIG. **4** is a side view, partially in section of the end of a package support tube and flexible tubing.

FIG. **5** is an end view, partially in section of the header.

FIG. **6** is a side elevation view of two of the creels of FIG. **1** showing the path yarn takes to enter a tufting machine with yarn from one creel traveling over the other creel.

FIG. **7** is a side elevation view of two yarn packages illustrating the problem of yarn falling from one yarn package to another yarn package and becoming entangled therein.

FIG. **8** is a side elevation view of two yarn packages and an air shunt in the flexible tubing for blowing air through the flexible tubing and a ring having lines for capturing any slack yarn to avoid the problem of the yarn becoming entangled as shown in FIG. **7**.

FIG. **9** is a perspective view of the ring, threaded shank and line affixed to the overlay upright taken at oval "**9**" in FIG. **8**.

FIG. **10** is a perspective view of the creel having the overlay upright, ring, shank and lines of FIG. **9** extending across the front and rear portions of the frame.

DETAILED DESCRIPTION

FIG. **1** is a perspective view of a compact creel **20** of this invention. The compact creel **20** includes a frame **22** having a front portion **24** and a rear portion **26**, multiple hollow supports **28** attached to the frame **22** for holding yarn packages **30**, and an attachable header **32**. Preferably, the frame **22** can hold about 832 yarn packages **30** with approximately 416 yarn packages **30** on each of the front **24** and rear **26** portions of a sixteen foot frame **22**. Generally, the yarn packages **30** have a diameter of about seven inches and are about twelve inches long. Preferably, the overall footprint of the compact creel **20** is on the order of 160 square feet or less. A variety of yarn packages **30** can be used with the compact creel **20** including yarn packages **30** containing yarn **33**, that is for instance, tightly twisted, loosely twisted and air entangled. Casters **34**, **36**, **38**, **40**, **42** and **44** placed on the bottom of the frame **22** provide for ease of movement of the compact creel **20**.

As illustrated in FIG. **1**, the yarn packages **30** of the creel **20** are arranged in compact staggered rows. The hollow supports **28** holding the yarn packages **30** are closely spaced, for instance about one inch apart, so that side-to-side and above-and-below positions of yarn packages **30** are close. This configuration is an improvement over the existing arrangements that requires large bobbins of yarn occupying substantial space before feeding into a tufting machine, and a labor intensive set up process. The compactness of the yarn packages **30**, the large quantity of yarn packages **30** fitting on a creel **20** and reductions in set-up and labor costs provide for a more efficient system for delivering yarn to a tufting machine.

Preferably, the front portion **24** and the rear portion **26** of the frame **12** define a passageway **46**. Flexible anti-static tubing **50** affixes to the header **32** at one end **52** of the flexible tubing **50** and travels through the passageway **46** with the other end **54** (not shown) of the flexible tubing **50** positioned through the hollow support **28**. Yarn **33** feeds through the flexible tubing **50** to the header **32**, and through the slots **56** in the header to the tufting machine (represented by dash line **58**). The arrangement of the header **32** and slots **56** ensures that yarns feeding into the tufting machine **58** lie in the same plane.

FIG. **2** shows a perspective view of the hollow support **28**. The hollow support **28** includes a tube **60**, a retainer spring clip **62**, and a connector **64**. The hollow support **28** can be configured, for instance, as a length of round or square pipe or metal tube. Preferably, the tube **60** is welded to the frame **22**, and the connector **64** having the retainer spring clip **62** attaches to the tube **60**. The connector **64** can attach to the tube by a variety of methods including, for instance, screwing, welding, and gluing. The tube **60** is hollow, allowing the flexible tubing **50** to be positioned therein. The yarn package **30** is removably placed on the hollow support **28**. An eyelet **66** formed by heat flaring the end **54** of the flexible tubing **50**.

During setup of the creel **20**, an end of a strand of yarn **33** is unwrapped from the yarn package **30**. The yarn **33** is blown through the flexible tubing **50** up to the header **32**. As yarn **33** spins off the yarn package **50**, the eyelet **66** serves to allow continuous feeding from the yarn package **30** through the flexible tubing **50**, aids the threading process and helps avoid wear as the yarn **33** is pulled through. Alternatively, a ceramic or ceramic-coated yarn eye may be attached to the end of the tube **60**. As shown in FIG. **2**, the flexible tubing **50** snakes behind the frame **22** and traverses up to the header **32**. The other end **52** of the flexible tubing **50** that affixes to the header **32** can also be heat flared ensuring the flexible tubing **50** remains in place on the header **32** by the heat flared end **68**. Preferably, yarn **33** removal from the yarn packages **30** onto the tufting machine **58** is relatively slow, with little wear on the heat flared end of the flexible tubing **50**.

FIG. **3** is a side elevation view of the front **24** and rear **26** portion of the frame **22** of the creel **20** of FIG. **1**. As shown in FIG. **3**, the flexible tubing **50** travels from the hollow support **28** up the passageway **46** of the frame **22** to the header **32**. As shown, both portions **24**, **26** of the frame **22** contain a plurality of yarn packages **30**. Yarn **33** inside the flexible tubing **50** travels through the passageway **46** to the header **32**. Yarn **33** exiting the header **32** aligns to enter the tufting machine **58**.

FIG. **4** is an enlarged side elevation view of the end tube **60**. Tube **60** contains the flexible tubing **50** with an eyelet **66** at the end **54** of the flexible tubing. The eyelet **66** serves to hold the flexible tubing **50** in place within the tube **60**.

FIG. **5** is an enlarged side view of the header **32**. The header **32** includes a first plate **70** and a second plate **72**. The flexible tubing **50** threads through the first plate **70**. The heat flared end **68** of the flexible tube **50** serves to keep the flexible tubing **50** from coming out of the first plate **72**. The heat flared end **68** of the flexible tubing **50** abuts the second plate **72**. The second plate **72** attaches to the first plate **70** by any connecting methods such as, for example, bolts **74**.

FIG. **6** is a side elevation view of two creels **20** and **21** placed one in front of the other. Because of the portable nature of the compact creel **20**, more than one compact creel **20**, **21** can be used at the same time with a tufting machine **58**. After one compact creel **20** is set up and connected to the tufting machine **58**, the second compact creel **21** can be placed into position and attached to the tufting machine **58**. The first creel **20** is positioned closest to the tufting machine **58**. The second creel **21** placed behind the first creel **20** has all the elements of the first creel **20** with an additional feature. The second creel **21** includes a yarn guide **74** for directing the yarn **33** exiting the header **32** over the first creel **20** and into the tufting machine **58**. The yarn guide **74** creates an angled path for the yarn **33** to traverse, as illustrated by directional arrow A-A to insure that the yarn **30** does not travel a path that would interfere with the operation

of the first creel **20**. The yarn **33** exiting the first creel **20** travels path B-B which is a separate path from path A-A.

In an alternative embodiment, the yarn guide **74** includes a yarn slide that is placed across the top of the compact creel **21**. The yarn guide can include a bar affixed to and positioned above an upper portion of the frame **22**. So that yarn coming from the header **32** of the second compact creel **21** into the tufting machine **58** is not damaged or broken when the first compact creel **20** slides into position, the yarn slide acts as a "roof" that allows the yarn to slide along an upper portion of the yarn slide as the first creel **20** is placed in proper position.

FIG. **7** is a schematic side elevation view of two yarn packages **30**A and **30**B illustrating how yarn **33**A falls from one yarn package **30**A to another yarn package **30**B and becomes entangled. The hollow support **28** that supports the yarn packages **30** (including **30**A and **30**B) allows the yarn to spool off at a variety of speeds including high speeds of about 800 rpm. Yarn packages **30** having different tensions of yarn **33** on the yarn packages **30** such as loosely twisted or tightly twisted yarn **33** can spool off the yarn package **30** at different rates. Yarn packages **30** containing different types of yarn **33** placed above each other can cause the yarn from one package to become entangled with another package. FIG. **7** shows this situation where the yarn **33**A from the upper yarn package **30**A has fallen onto the tube **60**B of the lower yarn package **30**B. This problem causes the yarn **33**A to jam, requiring stopping the operation of the creel to untangle the yarn packages **30**A and **30**B which can negatively affect productivity.

FIG. **8** shows a method for addressing the yarn entanglement problem including a ring having a line for capturing any slack yarn to avoid the problem of the yarn becoming entangled as shown in FIG. **7**. The ring **78** having a threaded shank **80** (shown in FIG. **9**) received in an overlay upright **81** and held in place by a nut **82**. A line or strand **84**, such as, for instance, fishing wire or monofilament line, loops through the ring **78** and extends across the overlay upright **81** and attaches at the opposite end of the overlay upright **81** (shown in FIG. **10**). The front portion **24** and rear portion **26** of the overlay upright **81** can contain such strands **84**. The placement of the ring **78** and strand **84** avoids the problem of yarn **33**A entanglement by supporting any loose yarn on the strand as shown at **86**. Further, even if yarn **33**A is very loose and falls down to the lower yarn package **30**B, the yarn follows the likely path shown at **87** and does not become entangled in the tube **60**B of the lower yarn package **30**B.

FIG. **8** also illustrates use of a shunt for blowing air through the flexible tubing **50**. Shunt **90** attaches to the flexible tubing **50** providing an alternative location for air entry to blow the yarn **33** through the flexible tubing **50**. In another alternative embodiment, multiple shunts can be fed by a single manifold so that air can simultaneously be blow through tubes **50**.

FIG. **9** is a perspective view of the ring **78**, shank **80** and strand **84** taken at oval "**9**" in FIG. **8**. The wire **84** extends across the front and rear portions **22**, **24** of the frame **22** such that yarn **33**A from an upper yarn package **30**A does not become entangled with yarn **33**B from a lower yarn package **30**B.

FIG. **10** is a perspective view of the front portion **24** of a compact creel **85** having the strands **84** of FIG. **9** extending across overlay uprights **81**. The overlay uprights **81** contain a series of rings **78** for attaching strands **84** between each horizontal row of yarn packages **30** to prevent yarn **33**A from an upper yarn package **30**A from inadvertently wrapping around a tube **60**B of a lower yarn package **30**B entangling the yarn **33**A.

Yarn reclamation can occur by stripping the yarn **33** from the yarn packages **30** without unloading the yarn packages **30** from the creel **20**, **21** and **85**. The ends of the yarn **33** in adjacent packages **30** are tied from head to tail. The portable creel **20**, **21** and **85** is placed in front of a backwinder head, and skinner yarn pieces wind onto one package or a few packages.

An advantage of this invention is that it provides a compact creel that substantially reduces wasted yarn while making a comparable sized carpet.

Yet another advantage of this invention is that it provides for improved quality by reducing yarn slack ends.

Still another advantage of this invention is that it improves plant through-put time because the warping process is eliminated for smaller jobs.

Another advantage of this invention is that it increases output because it provides for placing yarns of different thickness having different lengths on yarn packages directly next to each other on the compact creel. This also increases carpet design flexibility.

Some other advantages of the compressed, portable, tufting creel include:

Tufting setup time reduction
Carpet overrun overage reduction and control
Usable plant floor space increases
Yarn warehouse inventory reduction
Improved skinner yarn reclamation
Simplified scheduling of plant personnel
Material handling labor reduction
Redirection of non-value added labor to value added labor
Enhanced sample production

While certain embodiments of this invention have been described above, these descriptions are given for purposes of illustration and explanation. Variations, changes, modifications and departures from the systems and methods disclosed above may be adopted without departure from the scope or spirit of this invention.

The invention claimed is:

1. A compact creel comprising:

a) a portable, free-standing frame positioned a distance from a machine for making textile products;

b) holders affixed to the frame for holding yarn packages;

c) a header mountable on the frame for directing yarn from the yarn packages to the machine for using the yarn to make a textile product, wherein the header comprises a first plate having a plurality of holes; and

d) a plurality of flexible tubes for receiving yarn through a holder and guiding the yarn to the header, each flexible tube having a first end positioned at least partially in a holder and a second end secured to the header,

wherein the header directs yarn exiting the plurality of flexible tubes to the machine and wherein the distance between the frame and the machine is variable.

2. The compact creel of claim **1**, wherein each holder comprises a hollow tube affixed to the frame.

3. The compact creel of claim **2**, wherein each holder further comprises a retainer spring clip connected to the hollow tube for holding the yarn packages.

4. The compact creel of claim **1**, wherein at least one of the first and second ends of each flexible tube comprises an eyelet.

5. The compact creel of claim **1**, wherein the header further comprises a second plate having a plurality of holes

that align with the plurality of holes in the first plate, the second plate removably attached to the first plate.

6. The compact creel of claim **5**, wherein the second end secured to the header is disposed between the first and second plates of the header.

7. The compact creel of claim **1**, wherein holders are affixed to both a front portion and a rear portion of the frame.

8. The compact creel of claim **7**, further comprising a vertical passageway for receiving the flexible tubes between the front portion and the rear portion of the frame.

9. The compact creel of claim **1**, further comprising casters wheels on which the frame rests to enable it to be moved.

10. The compact creel of claim **1**, further comprising a yarn guide for guiding yarn from the frame over at least one other frame into the machine.

11. The compact creel of claim **1**, further comprising horizontal lines for preventing yarn from an upper yarn package from becoming entangled with another yarn package.

12. A method for providing yarn to a machine for using the yarn to make a textile product, comprising:

a) providing a compact creel comprising:

(i) a portable, free-standing frame;

(ii) holders affixed to the frame for holding yarn packages;

(iii) a header mounted on the frame for directing yarn from the yarn packages to the machine, wherein the header comprises a first plate having a plurality of holes; and

(iv) a plurality of flexible tubes, each for receiving yarn through a holder and guiding the yarn to the header, wherein the header directs yarn exiting the plurality of flexible tubes to the machine;

b) supplying yarn from the yarn packages to the header, wherein the yarn exits the header;

c) connecting the yarn exiting the header to yarn pieces coupled to the machine; and

d) moving the creel away from the machine after at least some of the yarn from the yarn packages has been supplied to the machine.

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